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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte CHIN-AN KAO, YUNG-CHANG CHANG, YU-PING CHANG,
and LING-SUNG WANG

Appeal 2010-001452
Application 10/661,793
Technology Center 2800

Before JOSEPH L. DIXON, JOHN A. JEFFERY, and THU A. DANG,
Administrative Patent Judges.

JEFFERY, *Administrative Patent Judge.*

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 8-11 and 15-17. Claims 1-7 have been cancelled, and claims 12-14 have been indicated as containing allowable subject matter. App. Br. 2. We have jurisdiction under 35 U.S.C. § 6(b). We reverse.

STATEMENT OF THE CASE

Appellants' invention uses feedback to control critical dimensions of openings formed in etch resist material, where the diameter of an opening in underlying insulation material depends on that formed in the etch resist material. *See generally* Spec. 5-6. Claim 1 is illustrative:

8. A system for creation of an opening of controllable format through a layer of insulation material, comprising:

means for creating an opening through a layer of etch resist material provided over the surface of a layer of insulating material having been deposited over the surface of a substrate;

means for measuring an obtained critical dimension measurement of said opening created through said layer of etch resist material;

means, including a feedback mechanism, for assuring that the obtained critical dimension measurement of said opening created through said layer of etch resist material is within design specification, said feedback mechanism communicating with said means for creating an opening through a layer of etch resist material to control said critical dimension measurement of said opening by implementing corrections in said means for creating an opening through a layer of etch resist material;

means for creating an opening through said layer of insulation material, whereby a diameter of said opening through said layer of insulation material is dependent on a diameter of said opening created through said layer of etch resist material; and

means, including a feedback mechanism, for assuring that said opening created through said layer of insulation material is within design specification.

The Examiner relies on the following as evidence of unpatentability:

Sahin

US 2003/0220708 A1

Nov. 27, 2003

(filed Nov. 27, 2002)

THE REJECTION

The Examiner rejected claims 8-11 and 15-17 under 35 U.S.C. § 102(e) as anticipated by Sahin. Ans. 3-9.¹

CONTENTIONS

The Examiner finds that Sahin discloses every recited feature of independent claim 8 including means for assuring that an obtained critical dimension measurement of an opening created through a layer of etch resist material is within design specification. Ans. 3-5, 10-13. This recited means is said to include a feedback mechanism communicating with a means for creating an opening through the etch resist material to control its critical dimension measurement by implementing corrections in the means for creating this opening. *Id.* In this regard, the Examiner relies principally on Sahin's technique in Figure 8A(1) that (1) inspects wafers received from a lithography tool for defects, and (2) reworks those wafers that contain defects or otherwise fail to meet specifications before etching. *Id.*

Appellants argue that Sahin's mere designation of defective wafers for rework does not use a feedback mechanism that communicates with the means for creating an opening in the etch resist material to control its critical dimension measurement by implementing corrections in the opening-creating means as claimed. App. Br. 12-18; Reply Br. 2-6. Although Appellants acknowledge that Sahin controls which wafers are sent to etching after the initial inspection and rework stage, Appellants nonetheless contend

¹ Throughout this opinion, we refer to (1) the Appeal Brief filed April 28, 2009; (2) the Examiner's Answer mailed August 6, 2009; and (3) the Reply Brief filed October 5, 2009.

that Sahin does not control the critical dimensions of the opening in the etch resist material as claimed, let alone communicate with a lithography tool to do so. *Id.* The issue before us, then, is as follows:

ISSUE

Under § 102, has the Examiner erred in rejecting claim 8 by finding that Sahin discloses means, including a feedback mechanism, for assuring that an obtained critical dimension measurement of an opening created through a layer of etch resist material is within design specification, the feedback mechanism communicating with a means for creating an opening through the etch resist material to control its critical dimension measurement by implementing corrections in the means for creating this opening?

FINDINGS OF FACT (FF)

1. According to Appellants:

The means for creating an opening through a layer of etch resist material is shown as section 15 of FIG 1 and photoresist function 30 of FIG. 3A. . . . Since the means for creating an opening through a layer of etch resist material is disclosed to including depositing (coating), patterning and developing the layer of photoresist, such means inherently includes the coating system, the lithography system and the developer system, hereinafter collectively referred to as “the lithography tools” . . .

App. Br. 4-5 (referring to Spec. 8).

2. Appellants’ Figure 1 includes section 15 (“Photo Procedure”) including step 21 (“Contact Photo”) comprising (1) depositing a photoresist layer over an insulative layer; and (2) patterning, developing, and creating an

opening through the photoresist layer. The opening is then measured and inspected in steps 22 and 23. Spec. 8; Fig. 1.

3. Appellants' photoresist function 30 in Figure 3a re-routes data related to products that fail to meet limits (i.e., the opening's critical dimension is not within specification or tolerance) to the photoresist function's entry point via software link 44. After completing this function, the etch function 35 of Figure 3b is invoked which has a similar evaluation and feedback function via software link 74. *See generally* Spec. 12-23; Figs. 3a-3b.

4. Sahin's system 100 forms shallow trench isolation (STI) regions in a semiconductor substrate. The system includes various tools, including etch tool 102, that communicate with module controller 114. Sahin, ¶¶ 0003, 0005, 0048-49, 0064, 0070; Figs. 1A-1B.

5. In the process of Sahin's Figure 8A(1), system 100 receives a cassette of substrates (e.g., each having a patterned masking layer formed thereon) from an unshown lithography tool. The cassette is then delivered to etch tool 102 where the wafers are inspected for (1) defects, and (2) whether measured critical dimensions and profiles of the patterned masking layer are within specifications. Wafers failing either test are reworked (if possible) before etching, but wafers passing both tests are etched in step 812 of Figure 8A(2). Sahin, ¶¶ 0206-12; Figs. 8A(1)-8A(2).

6. Sahin notes that reworking a wafer may involve using (1) etch tool 102 to ash the photoresist layer, and (2) cleaning tool 104 to remove residual photoresist. Sahin, ¶ 0209.

ANALYSIS

We begin by construing the key disputed limitation of claim 8 which recites, in pertinent part, means, including a feedback mechanism, for assuring that an obtained critical dimension measurement of an opening created through a layer of etch resist material is within design specification, the feedback mechanism communicating with a means for creating an opening through a layer of etch resist material. Since claim 8 includes two means-plus-function limitations pertinent to this appeal, namely (1) means for creating an opening through a layer of etch resist material, and (2) means for assuring that the obtained critical dimension measurement of an opening created through a layer of etch resist material is within design specification, we therefore construe these terms based on the corresponding structure disclosed in Appellants' Specification and its equivalents. *In re Donaldson Co., Inc.*, 16 F.3d 1189, 1193 (Fed. Cir. 1994) (en banc).

In the "Summary of Claimed Subject Matter" section of their Brief, Appellants note that the means for creating an opening through a layer of etch resist material is shown in section 15 of Figure 1 and photoresist function 30 in Figure 3a. FF 1. Appellants add that this disclosed means inherently includes the (1) coating; (2) lithography; and (3) developing systems which Appellants collectively label as "lithography tools." *Id.* This mapping reasonably comports with the corresponding description of the disclosed photoresist procedure which not only forms the photoresist, but also creates openings therein that are measured and inspected. *See* FF 2. And as shown in Appellants' Figure 3a, a key aspect of this initial photoresist function is the feedback mechanism that ensures that openings made via this process are within specifications before etching—a subsequent

process with a similar feedback function. FF 3. We therefore construe the recited means for (1) creating an opening through a layer of etch resist material, and (2) assuring that the obtained critical dimension measurement of an opening created through a layer of etch resist material is within design specification as corresponding to Appellants' description and its equivalents.

With this claim construction, we find the Examiner's reliance on Sahin problematic. First, the wafer masking layer inspections and measurements in Sahin's Figure 8A(1) are performed by Sahin's etch tool 102—a tool that is distinct from the lithography tool from which the wafers were received as indicated in step 802. FF 5. As such, we fail to see any communication between the feedback mechanism of this process that reworks rejected wafers and the lithography tools that form the openings in the etch resist material on which these inspections are based. That is, Sahin's feedback loop is contained solely within the etch tool: it does not communicate with—let alone control—the lithography tools that initially form the openings in the etch resist material before being sent to the etch tool. *See* FF 5.

Nor can we say that “reworking” rejected wafers via this internal etch-tool feedback necessarily implements corrections in creating openings, let alone in etch resist material as claimed. Apart from briefly mentioning an exemplary rework process involving ashing and cleaning a photoresist layer (FF 6), Sahin is short on specifics on exactly what constitutes reworking wafers in this initial process. Appellants, however, acknowledge that “reworking” a wafer involves (1) removing photoresist material; (2) recoating the wafer; and (3) processing the wafer through the photolithographic process again. Reply Br. 5. Nevertheless, even assuming,

without deciding, that this repeated photolithographic processing creates openings through the reapplied photoresist material, we cannot say that any corrections or adjustments in creating these openings are necessarily implemented via this feedback—a crucial requirement of claim 8. *See* FF 5-6. Rather, this process is simply repeated as Appellants indicate. Reply Br. 5-6. *See* FF 5.

We are therefore persuaded that the Examiner erred in rejecting (1) independent claim 8; (2) independent claims 15 and 16 which recite commensurate limitations; and (3) the dependent claims for similar reasons.

CONCLUSION

The Examiner erred in rejecting claims 8-11 and 15-17 under § 102.

ORDER

The Examiner's decision rejecting claims 8-11 and 15-17 is reversed.

REVERSED